DEVELOPMENT OF FACE RECOGNISABLE AI ROBOT

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Abstract – In today's world, Facial recognition by image processing is one of the most and advanced and recent foundations. Facial recognition is a fundamental step in approaching various security systems, data sets for identification of an individual, law enforcement, personal safety, biometrics, etc. This model has been developed can detect a face (known and unknown) among other objects from an image and recognize the faces by matching it with a previously made database using Neural Network. This system will have a predefined set of data. A face, when detected, will be matched with the dataset to find a resemblance. In this paper, A robot has been designed in such a way that it can recognize and track faces and then mention the person's name and also can interact with people via speeches. It can also show live video footage to the controller person`s device.A system has been designed using Cascade classification and Local Binary Pattern Histogram (LBPH) Face Recognizer method based on OpenCV library and Python Language. The movement of the robot is controlled by Nodemcu microcontroller board and is wirelessly connected to controlling person`s smartphone via inbuilt WI-FI modules of these two devices. The controller person can control the robot via a Nodemcu controller Application. It can be used in various fields like surveillance purposes to experiments purposes.

Keywords - facial recognition; neural networks; openCV; LBPH

1.0 Introduction

Technological development made closed-circuit television (CCTV) famous in workplace in addition to domestic surveillance applications. Surveillance of every and each nook within side the area, the usage of a CCTV isn't price effective. Also, this surveillance calls for a human operator to hit upon and apprehend the individual and as a result there are possibilities of human errors. CCTV structures on my own can't deliver 100% surveillance . So, for those problems, we want a gadget that may hit upon and apprehend faces robotically and may be managed each manually and robotically. To put in force those capabilities, we want an AI robotic however to start with we want to realize what's AI?

Artificial Intelligence (AI) is an idea that attempts to apprehend the human intelligence and wondering to provide a gadget that mimics human intelligence.

In this paper, we present an AI surveillance robotic that can detect and recognize faces and its motion may be managed through any Smartphone. Also, the robotic can engage with human beings through speeches. So, it is able to be used to locate missing persons, for statement functions and in different fields.

The face recognition functionality has two main principal approaches, Geometric (function based totally) and photometric (view based totally):

- Geometric: Is primarily based totally on geometrical dating among facial landmarks, or in different phrases the spatial configuration of facial capabilities. That method that the principle geometrical capabilities of the face together with the eyes, nostril and mouth are first positioned after which faces are labeled on the premise of numerous geometrical distances and angles among capabilities.

- Photometric stereo: Used to get better the form of an item from some of pictures taken below specific lighting fixtures conditions. The form of the recovered item is described through a gradient map, that is made of an array of floor normals (Zhao and Chellappa, 2006)

In this present paper, A technique has been implemented for more accurate facial recognition. A system will have a previous database with at least 30 pictures of an individual stored and fed to the system. The system will at first detect the face of a person by taking photographs from video frame and therefore after applying algorithms to it clear out a specific grayscale image of the face and run through the database for a match up to a certain percentage which can be set under certain conditions like the quality of the camera, changes in the face like noticeable marks, colors, change in texture and aging of the individual through time. Any sort of drastic change may falter the algorithm, which will prevent from detecting even a known person. When a match is found, The name of the person will be shown under his face in a currently running video frame. In order to update the network, software such as Python IDLE to code the algorithm and openCV as an application have been used. The first layer receives the raw input information. Each successive row gets the output from the row preceding it. The last layer produces the output of the system. Neural networks are notable for being adaptive, which means they modify themselves as they learn from initial training and subsequent runs provide more information about the world. Our system will be fed with data beforehand with some odd images to help the classifier to differentiate between a real-life person standing or a picture of the same or a digital image. This will give the system an upper hand for security measures in case of threats. The cramped conditions to this system also depend on the quality of the camera, pixel quality to be precise.

2.0 MATERIALS and METHODOLOGY:

Materials Used: 1.NodeMcu Micro-controller
2. Raspberry Pi 3B Micro-computer
3. Arduino Uno Micro-controller
4. Motor Driver L298N
5. 12V Johnson Motor
6. Servo Motor
7. Castor Wheels
8. Wide Wheels
9. Acrylic Sheet
10. Wires
11. Lithium-ion Battery
12. Power Bank

Methodology:
The steps involved in face recognition task are as follows:

Identifying all the faces: In this step, face detection is performed, and the Face is converted

into gradients. At this step the goal would be to detect only the faces in the image.

Analysing and projecting faces: This step includes finding landmarks on the detected Face using the Histogram of Gradients method [4].

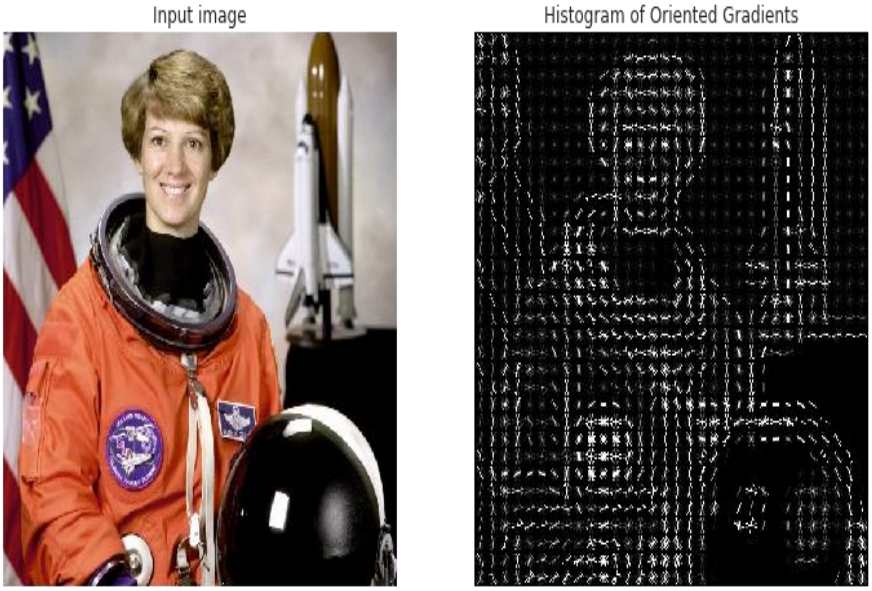

Figure 1: Analyzing and Projecting faces

Encoding-faces: This step includes extracting few measurements from the detected Face and performs a comparison between known faces and unknown faces (input).Finding the individuals name from the encoding. Finally, at this stage we train SVM classifier and obtain the name of the person as output.

Controlling the Robot: To control the robot we will use a Nodemcu controller Application in our smartphones that will be wirelessly connected to the Nodemcu Microcontroller board.

Speech Programming: For the speech programming, we have used python language and OPENCV library to implement some pre-registered speeches and we have used the Google assistant to build its human like voice.

System Design: For the movement of the robot, we have connected 4 Li-ion batteries to Motor Driver L298N and the motor are connected to the motor driver. The NodeMcu is connected to the motor driver board. The batteries giving 15V to the motor driver and it is distributing the voltage to the NodeMcu and the Motors. The NodeMcu board is powered by 5 Volts from the motor driver. Above 5 Volts can damage the NodeMcu circuit. For surveillance and face recognition, we connected a power bank to the Raspberry Pi board. We have connected a Pi cam. For the rotation of the camera, we connected an Arduino Uno board to the servo motor and the servo motor is attached with the camera. The Arduino Uno board is powered by a Li-ion battery connected with it.

3.0 Block Diagram:

3.1 Face Recognition Block Diagram:

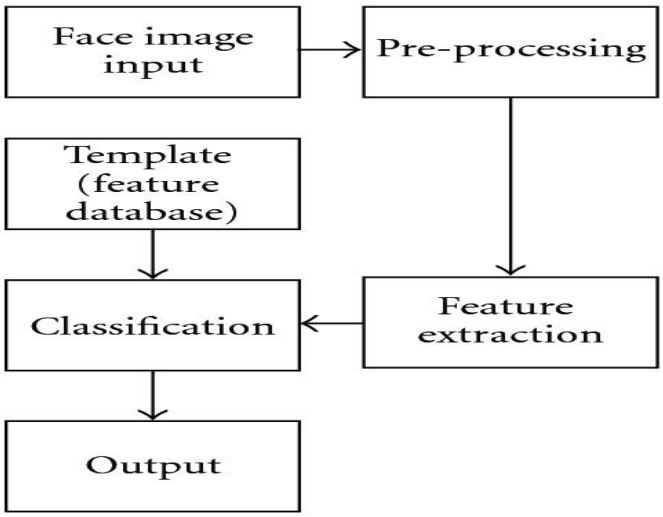

Figure 2: Block Diagram of Face recognition

Steps:
1. Image input: to acquire a digital image.
2. Image pre-processing: Partitions an input image into its constituent parts of objects. Converts the input data to a from suitable for computer processing.
3. Template (feature database) : The features of the trained images are stored and the classifier checks the input images with the feature database.
4. Image Feature extraction: In this step, the system extracts the features of the input image and checks some quantitative information and checks some basic similarities from the trained images.
5. Image Classification: In this step, the system checks if the features of the input image matches with the features of featured database images.
6. Image recognition/Output: to assign a label to an object based on the information provided by its description.

3.2 Block Diagram (Speech Program):

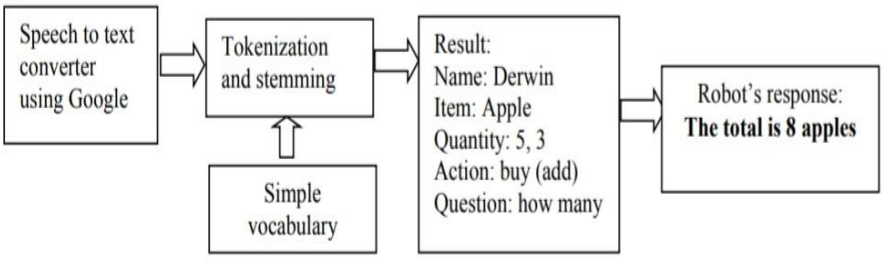

Figure 3: Block Diagram of Speech Program

Steps: 1. Speech to text converter: The user's speech is converted to computer text using Google assistant.
2. Tokenization and Stemming: The text is processed using simple computer vocabulary and is checked if the texts are matching with pre-registered texts.
3. Result: If the texts match the result is processed.
4. Response: The result is told by the robot using google voice assistant.

3.3 Block Diagram (Robot Movement):

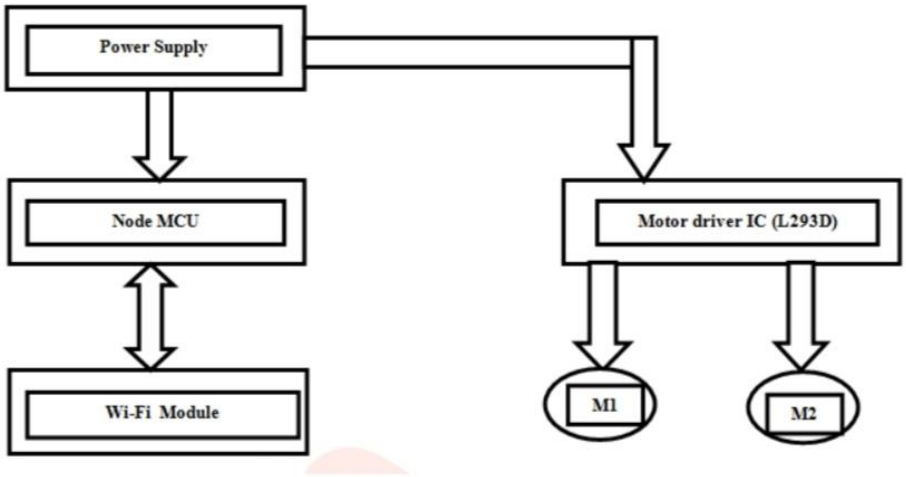

Figure 4: Block Diagram of Robot Movement

Here is the block diagram for this Wi-Fi Controller car part of the robot Using Esp8266 Project designed using Fritzing software. We will control the two DC motors via L298 Motor Driver IC. I used L298N. This is a high-power motor driver capable of running 5V to 35V DC Motor at a maximum of 25W.We have used 500 RPM DC Motor for this application. The main control unit is ESP8266 Board which connects and controls the entire circuit and equipment. We have connected the battery to the L298 Motor Driver power supply input. Then we connected all 6 inputs of L298 to ESP8266 D3, D4, D7, D8, D5 & D6 Pin. Supply 5V to Wemos through L298 5V Pin. Connected the output pins of L298 to left and right motors.

4.0 RESULTS and DISCUSSION:

We have successfully developed this face recognizable IoT based AI surveillance robot and it is fully functional. We have achieved all the objectives of this project. It can recognize faces stored in data base and it can also interact with known and unknown persons and it can constantly train itself to recognize more

5.0 Application

1. This robot can be used to find missing persons using its face recognition system. The programmer can insert the image of the missing person in the face recognition program, so it can be used to find missing person during the golden hours.
2. This robot can be used in hostile situations where army personnel can use it as a surveillance bot.
3. This robot can be used to in hospitals where very infective disease patients are kept. It can announce statements to the patients and also with some future modifications it can be used to deliver food, medicine to those patients. Many Europeans countries using this kind of robots in hospitals.
4. With some modifications, it can also be used to serve food in restaurants.

6.0 CONCLUSION:

To develop this project we have learnt Machine Learning and Deep Learning which are one of the most important and trending parts of modern coding. With the success of this project, we would like to continue our research work in this field and develop much more advanced robots which can solve real life problems.

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